

A comparison of two physiotherapy treatment approaches to improve walking in multiple sclerosis: a pilot randomized controlled study

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Objective : To use a pilot study to compare two physiotherapy approaches to improve walking in patients with gait disturbance due to multiple sclerosis (MS).

Design : Patients were assessed and then randomly assigned to one of two groups using a block randomization technique. They were treated by the research physiotherapist for a minimum of 15 treatments over a 5-7-week period and then reassessed by an independent therapist one week after treatment.

Setting : Both assessment and treatment were undertaken at a specialist rehabilitation centre.

Subjects : Outpatients with clinically stable MS (chronic progressive or relapsing-remitting types) who were referred for physiotherapy to improve their mobility.

Intervention : Comparison was between a facilitation (impairment-based) approach and a task-oriented (disability-focused) approach.

Outcome : Mobility was assessed using four measures: the 10-metre timed walk, the Rivermead Mobility Index, stride length and the Rivermead Visual Gait Assessment. Balance was assessed using the Berg Balance Test.

Results : Twenty-three patients were entered, and 10 in each group completed the study. The groups were similar on all measured items both before and after treatment. There was no significant difference in improvement between the two approaches. Following treatment, patients in both groups showed a significant overall improvement ($p < 0.05$) in both impairment and disability measures.

Conclusions : No significant differences in effectiveness between the two methods were demonstrated. Both a task-oriented approach and a facilitation approach to the treatment of MS outpatients were associated with improved mobility.

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Introduction

Population surveys indicate that approximately 75% of people with multiple sclerosis (MS) experience mobility problems.^{1,2} Therapy is commonly suggested or requested, often on an outpatient basis. The value of short courses of outpatient treatment in progressive conditions, which are commonly given by physiotherapists, is uncertain and there is little evidence to guide the therapist on the most effective approach.

Several recent studies have evaluated short-term inpatient rehabilitation in MS, using outcome measures which include assessment of locomotor disability. One randomized controlled trial found that significant benefits accrued at the time of discharge from a two-week inpatient rehabilitation stay,³ but another randomized, controlled cross-over study found that mobility did not improve in 45 patients when they were assessed at home following a 2–3-week course of inpatient physiotherapy.⁴ There are also several uncontrolled studies reported. One⁵ reported an improvement in function in 79 patients with MS following multidisciplinary rehabilitation given for an average of two weeks. Another⁶ noted an improvement in disability measures in 28 patients who had ataxia after eight sessions of occupational therapy and physiotherapy, without a significant change in the level of impairment. De Souza and Worthington⁷ evaluated long-term outpatient physiotherapy for 40 MS patients over an 18-month period and suggested that treatment improved daily living activities and mobility.

One difficulty in interpreting these studies is that the therapeutic approach used is rarely specified, and may itself vary both between patients within a study and between studies. Physiotherapy treatment in neurorehabilitation is most often directed towards reducing impairment, with the overall goal of improving levels of disability and handicap. Current practice is dominated by two distinct treatment approaches which can be broadly termed 'facilitation' and 'task-oriented'.⁸

The 'facilitation' approach assumes that the central nervous system can be modified and motor control improved if the patient experiences normal movement through correct handling. Appropriate proprioceptive feedback is provided by skilled therapists who use techniques

that vary according to the specific treatment method.^{9–11}

The 'task-oriented' approach is a more recent development in physiotherapy, and involves goal-directed retraining on functional tasks. The assumption underlying this treatment approach relates to the specificity of motor learning and is based on the skill acquisition theory, which describes the need to practice a task in order to achieve mastery.¹² The motor relearning approach¹³ is based on this model.

There is little evidence at present to support the superiority of any one approach.¹⁴ Results from a recent randomized controlled pilot study in stroke showed that the gait velocity of stroke patients ($n = 9$) who received task-oriented gait training improved more when compared to two groups who received impairment-based therapy using Bobath and Brunstrom techniques, supporting a specificity of training effect.¹⁵

This pilot study set out explicitly to evaluate and compare the improvement in mobility seen in outpatients with multiple sclerosis arising from two contrasting approaches: a facilitation approach and a task-oriented approach. The study had several aims: (a) to establish the practicality of evaluating two different therapy approaches; (b) to establish whether both approaches had a beneficial effect and that neither was detrimental; and (c) to establish whether outpatient physiotherapy might improve the mobility of patients with MS.

Method

Patients with multiple sclerosis referred or self-referred to a specialist rehabilitation service (Rivermead Rehabilitation Centre; RRC) for physiotherapy to improve mobility were included in the study if they met the following criteria: they were able to walk 10 m inside with or without supervision; they had not had a (clinically apparent) relapse within three months before entry; and they were willing to give informed consent to participate in the study. Written information about the study was provided and informed consent obtained. The study was approved by the Nursing and Allied Professions Research Ethics Committee (NAPREC no.

1207), and was carried out between June and December 1996.

Patients were assessed by the treating therapist to establish suitability for the study. Once accepted into the study, patients were randomly allocated to one of two groups, using sealed envelopes and block randomization.¹⁶ Treatment was given for 5–7 weeks, and the outcome was assessed at Rivermead by an independent assessor one week after the end of treatment.

Assessments

Mobility was measured using the 10-metre timed walk,¹⁷ the Rivermead Mobility Index¹⁸ (score range 0 = no function to 15 = able to run), stride length¹⁹ and the Rivermead Visual Gait Assessment (RVGA).²⁰ The RVGA is a measure of the quality of gait (score range from 0 = normal gait to 59 = maximum abnormality) and the sum of all abnormalities was used as a 'global gait score' to reflect the degree of gait abnormality. For all gait assessments patients were asked to walk at their normal speed, with the aids and orthoses they routinely used. To obtain stride length patients walked on a 10-m grid placed directly onto the floor and divided into 3-cm sections.¹⁹ The therapist walked behind the patient and noted (with the use of a tape-recorder) the point on the grid where each heel strike occurred.

In addition, balance was measured using the Berg Balance Test, which consists of 14 items that measure functional balance on a four-point ordinal scale.²¹ Subjects were assessed clinically for sensory appreciation of the legs (kinaesthesia, vibration and bilateral simultaneous touch), tone in the extensor and plantar flexor muscles of the leg using the Ashworth Scale²² and muscle length. Associated problems (e.g. ataxia, pain and arthritis) were noted. At the final assessment patients were asked to rate the value of the physiotherapy input on a four-point scale, ranging from 0 = not helpful, to 3 = extremely helpful.

Treatment approaches

Although the two treatment approaches used in this study do not directly correspond to any previously defined therapeutic model, they approximate to what is generally considered to be the 'facilitation' and 'task-oriented'

approaches. The two approaches were operationally defined as follows.

The *facilitation* treatment (group F) aimed at reducing impairments identified on initial assessment and recorded in terms of postural control, balance responses, the ability to recruit motor activity in different parts of the range, muscle length, tone change and bony malalignment. A problem-solving approach was employed to determine the nature of motor dysfunction, using observation and handling. Both passive and active techniques were used; the specific choice of technique was influenced by the type of impairment and the relative contribution it made to the overall motor deficit. Progression of treatment was determined by the rate of change in impairment and function was reassessed as necessary. This approach can be characterized as attempting to reduce the patient's impairments, expecting disability to be improved as a direct consequence.

The *task-oriented* treatment (group T) required patients to carry out a programme of functional exercises written by the therapist and based on the necessary components required for walking and functional mobility. The initial assessment was used to assess the ability of the patient to perform the tasks. Tasks were modified where necessary in order to optimize performance. Verbal instruction was given to ensure that the position of the body and the alignment of limb segments were as correct as possible, and that the specific task was performed in the correct way. Compensatory strategies (i.e. achieving the task by 'abnormal' means) were not specifically avoided. Nine of the 19 exercises employed involved functional exercises rather than component-practice tasks, e.g. stairs, walking in different directions and treadmill walking. The therapist recorded the number of repetitions for each task and treatment progressed by increasing both the number of repetitions and (for some tasks) decreasing the time factor. Unlike the facilitation approach, this approach focuses on the patient's disability, and anticipates that impairments might reduce as a consequence of improved function.

Although there are overlaps between the approaches, the crucial differences are summarized in Table 1, and details of the treatment pro-

protocols for both groups are shown in the Appendix. Procedures common to both groups included the involvement of the patient in both the aims and the progression of treatment, and in the goals to be attained. Verbal feedback, while more explicit in the task group, was nevertheless also a feature of the facilitation treatment. Orthotics and walking aids were prescribed for patients from both groups if required.

The patients were treated by the research therapist (a senior physiotherapist with a background in neurological rehabilitation with postgraduate training in Bobath, Carr and Shepherd, and Knott and Voss techniques). Each treatment session lasted for one hour interspersed with rest periods. The number of treatments ranged from 15 to 19 over a period of 5-7 weeks.

Data analysis

Subject characteristics in both groups were compared using the chi-squared test and the unrelated *t*-test. Pre- and post-treatment observations were analysed using the Wilcoxon signed-ranks test and the related *t*-test. The difference in scores for each variable between the two groups was compared using the Mann-Whitney *U*-test (nonparametric) and the Student's unrelated *t*-test (parametric). The change in gait parameters for individual subjects was expressed as a percentage of the difference between

the first assessment and the discharge assessment.

It is difficult to evaluate the clinical significance of changes because the size of clinically significant changes have not been determined for MS patients using most of these measures. We considered patients to have made a clinically significant improvement if there was: a decrease in walking time greater than 28%²³; an increase in stride length greater than 25%; an increase of 6 points on the global gait score; an increase of 6 points on the Berg Balance Test score; and an increase on the RMI of 2 points.¹⁸

Results

Twenty-three patients were entered into the study and 20 were assessed on completion of the treatment period (Figure 1). Three subjects (two from the facilitation group and one from the task group) were withdrawn from the study due to a relapse or further medical intervention.

The two groups were similar with respect to all variables both initially and after treatment (Tables 2 and 3) with no statistically significant differences between them at either point (Mann-Whitney *U*-test and *t*-test). The ratio of women to men in groups F and T were 8:2 and 7:3, the ratio of sensory impairment to normal

Table 1 Key differences between facilitation and task-oriented treatments

	Group F Facilitation (impairment-based)	Group T Task-oriented (disability-based)
<i>Assessment</i>	Qualitative: related to impairments restricting normal movement	Quantitative: related to task demands
<i>Treatment Procedure</i>	Predominantly hands-on, specific input to elicit desired response, activity varies	Hands-off, independent as possible, repetitive activity
<i>Feedback</i>	Manual and verbal	Written and verbal
<i>Progression</i>	Reduced level of input: progress to hands-off when satisfied with quality of movement and sustained improvement in quality of motor performance Introduction of functional tasks only when motor control has improved	Task modification: increase difficulty according to quantified performance (time taken and repetition rate)
<i>Evaluation</i>	Attainment of specific goals at level of impairment Ongoing assessment by therapist and patient on quality of performance	Use of written records Attainment of functional goals at level of disability

sensation was 6:4 and 7:3, and the ratio of associated problems to no associated problems was 5:5 and 7:3, respectively.

The score changes following treatment are shown in Table 4. As can be seen, no significant difference was found in score changes between the facilitation and task-oriented groups, including walking time ($p = 0.51$). Both groups improved between the pre- and post-treatment assessments (paired t -test and Wilcoxon test). A significant difference was found between all pre- and post-treatment measures in the facilitation group apart from walking time ($p = 0.06$); the mean change in walking time was 9.3 ± 14.7 s.

One subject walked slower following treatment (an increase from 21 to 31.5 s) possibly in order to improve the quality of the gait pattern. A significant difference was found between all pre- and post-treatment measures in the task-oriented group; the mean change in walking time was 6.0 ± 4.7 s. The significant levels for all other pre- and post-treatment measures were similar: balance ($p < 0.01$), RMI ($p < 0.05$), gait score ($p < 0.05$), stride length for group F ($p = 0.01$) and for group T ($p < 0.05$).

Using the definitions of clinically significant improvement described earlier, 10 patients improved clinically during treatment on at least

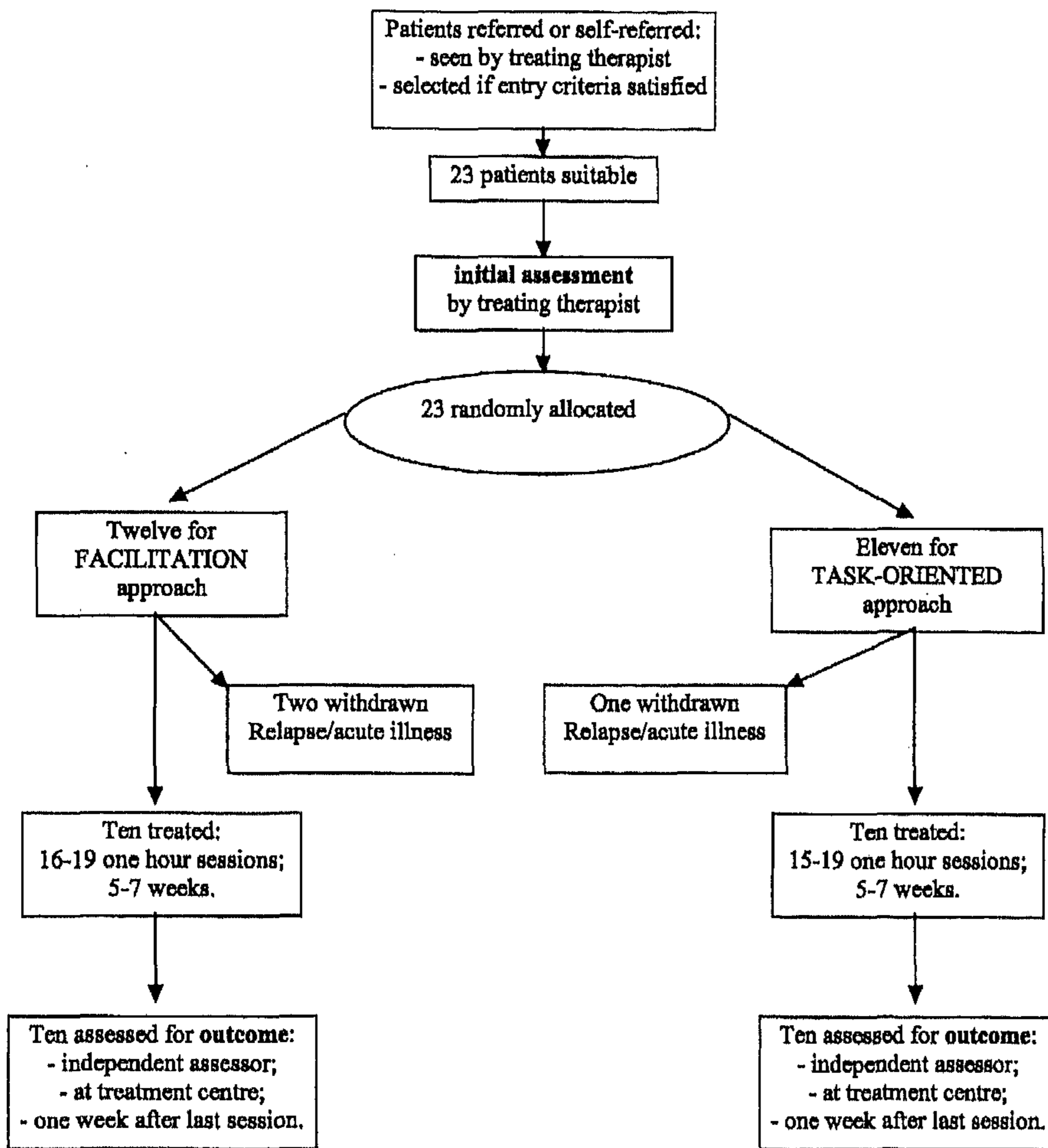


Figure 1 Flow of patients through the study

Table 2 Data on entry to the study

Assessment	Group F			Group T		
	Mean	SD	Range	Mean	SD	Range
Age	52.1	11.0	35-69	54.1	8.1	43-65
Onset MS (no. of years)	18.3	7.0	9-28	14.0	8.1	4-26
Problems with walking (years)	7.1	4.6	1.5-18	7.8	4.7	2-16

Table 3 Initial and final scores and therapy sessions given for both groups

	Group F				Group T			
	Mean	SD	Median	Range	Mean	SD	Median	Range
<i>Initial assessment</i>								
Walking time (s)	33.02	17.6	28.1	14.5-59.7	24.0	8.2	21.8	7-48
Stride length (cm)	75.3	16.3	74.9	51.1-101.6	82.0	10.7	81.3	65.1-102
Global Gait Score	29.1	10.5	27	15-45	27.4	9.4	30.5	9-39
Berg Balance Test	35	16.4	34	14-54	39.1	12.3	44	13-51
RMI	10.9	2.3	12.0	7-13	10.8	2.1	11	6-13
<i>Therapy treatments</i>								
	17.8	0.91	18	16-9	17.0	1.4	17.5	15-19
<i>Final assessment</i>								
Walking time (s)	23.7	14.7	23.7	8.5-48	18.0	7.4	17.4	7-33
Stride length (cm)	92.9	19.2	92.6	67.1-120.1	97.7	20.6	95.4	74.1-145
Global Gait Score	22.7	9.9	18	11-41	23.7	10.4	25.5	3-40
Berg Balance Test	43.5	11.1	46	25-55	46.3	8.8	48.5	31-56
RMI	12.1	1.9	12.5	8-14	11.6	2.1	12.5	7-14

Table 4 Changes in impairment and disability measures for both groups

Assessment	Change score group F				Change score group T			
	Mean	SD	Median	Range	Mean	SD	Median	Range
Walking time (s)	-9.3	14.7	7.3	+10.5 to -43.7	-6.0	4.7	7.2	+2.8 to -10.8
Stride length (cm)	17.6	18.6	20.9	-11.2 to +39.6	15.7	19.4	10.4	-7.9 to +26.7
Global Gait Score	6.5	9.1	18	-4 to +29	4.7	3.8	5.5	-1 to +11
Berg Balance Test	8.5	7.6	5	0 to +20	7.2	5.5	7	0 to +20
RMI	1.2	1.5	1.0	0 to +5	0.8	0.7	1.0	0 to +2

three of the outcome measures. The Berg Balance Test was the most sensitive to change; 7 of the 10 patients whose walking time did not improve by 28% improved their balance score by 6 or more. Seventeen of the patients rated the value of physiotherapy as extremely helpful, and three patients rated it as moderately helpful (one from group F and two from group T).

Five patients (two from group F and three from group T) who improved significantly in gait parameters were reassessed at a follow-up

appointment 7-10 weeks after discharge. Four of these had maintained their level of improvement, without any follow-up physiotherapy.

Discussion

This pilot study has shown that patients with multiple sclerosis (MS) can improve when given a short course of outpatient physiotherapy, and that the gains made in mobility are reasonably

similar for outpatients with MS whether a task-oriented approach or a facilitation approach is used. No deleterious effects related to either approach were found. Although it was practical to undertake a research study comparing the two treatment approaches, the absence of any discernible difference makes it difficult to know how easily distinguishable the two approaches were in clinical practice.

The study has several limitations. The sample was small, and no definitive conclusions can be drawn about the relative effectiveness of the two approaches except to note that differences, if they exist, are not large. The study did not include an untreated control group and so conclusions about specific benefits arising from either treatment need to be drawn cautiously. However, the results are consistent with previous studies comparing treatment approaches in stroke patients.¹⁵

The key differences between the two treatment approaches used relates to the level of the assessment and the types of intervention. In the facilitation group this relates primarily (but not exclusively) to impairment, whereas in the task group the focus was predominantly one of disability. In the facilitation group the initial clinical assessment was detailed and involved identifying the specific impairments thought to relate to gait disability, whereas in the task group the assessment simply involved establishing the patient's current level of functional ability. In the facilitation group the primary aim of treatment was to reduce impairments employing specific techniques, whereas in the task group the aim was to modify a task so that the patient could achieve it. Different tasks were used according to the patient's ability. In practice it was easy for the physiotherapist to maintain the distinction between the two treatment approaches.

The lack of any major difference in outcome between the two approaches is perhaps surprising given the distinctive nature of the two approaches. Whereas the task-oriented approach was similar for every patient, the facilitation approach was tailor-made to suit the individual patient, with a specific assessment which enabled impairments to be identified and a flexible treatment regime to be given. The emphasis of the facilitation group was on regaining normal selec-

tive movement, a difficult goal to achieve given that patients had experienced problems with walking for an average of seven years when compensatory strategies may have developed.

The widespread clinical belief (not supported by evidence) that patients in the task-oriented group would improve only through further compensation (i.e. doing things in more 'abnormal' ways) was not confirmed. Results from this study show that a task-oriented approach did not preclude improvement at the impairment level; both groups improved significantly after treatment in the global gait score and on the Berg Balance Test, both of which measure impairment. It could be argued that these measures are not sufficiently sensitive to discern a change in the quality of performance. However patients in both groups also reported a subjective change at the impairment level with regard to increased sensory awareness, muscle strength, reduced tone and increased muscle length. These changes, which were supported in some instances by clinical examination, were recorded but were not analysed in this study.

The improvement of patients in the task-oriented group may be due in part to the type of exercises used which focused specifically on walking and functional mobility, and were defined with this goal in mind. Because the tasks were carried out in the upright position, the activation and sequence of synergistic muscle activity, the alignment of limb segments, the activity of somatosensory receptors and balance mechanisms were all operational in ways that were determined by the task itself. This practical approach avoided the need for patients to improve their motor control in one position and then attempt to carry the skill over into the functional task, where the requirements may in fact be different. The therapist directed the activity and encouraged correct alignment and appropriate postural control; hand support which was often required in the early stages was reduced if the patient could achieve the task without compensation elsewhere.

Patients from both groups received physiotherapy on a one-to-one basis. Although treatment for the task-oriented group was chosen from a restricted range of potential tasks (see Appendix), it still required skills from the phys-

iotherapist which were used during the assessment and implementation of treatment. Further research may establish whether it is possible to achieve the same results with less specialist input.

Another potential weakness is that patients in both groups were treated by the same therapist. It may be that a single therapist cannot give extremely contrasting forms of therapy. However the advantages of using a single therapist include both controlling for the therapist's personality and for the quality of the therapist-patient relationship.

The treating therapist also undertook the initial assessment. However this was undertaken before randomization and group allocation, and should not bias the results.

The outcome measures used proved sensitive to change, and have been used in other studies.²⁴ It is unlikely that the failure to detect difference arose simply from poor measurement. All the patients reported that the treatment was worthwhile, including those patients who had not improved on gait parameters. The improvement in balance alone made a difference for these patients when carrying out functional tasks, e.g. dressing.

In conclusion, we have shown that there are no major difference in outcome between two different physiotherapy approaches when used with outpatients with MS, although small differences may have been missed in such a small study. The results suggest that patients with multiple sclerosis may benefit from a short period of outpatient physiotherapy focused on improving mobility. Further research is needed with a larger sample to establish whether outpatient therapy is effective in the long-term and whether either treatment approach is more efficient or effective than the other.

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Appendix – The treatment principles

Impairment-based physiotherapy (group F)

Treatment was based on the cause of the problems identified on assessment, in particular the type and extent of deviation from normal movement, and its relative contribution to the altered performance. Variations in techniques depended on the patient's response to treatment. The following broad categories of deviations and treatment techniques can be described:

- 1) *Deviation*: inability to facilitate trunk righting and stepping reactions due to the poor quality of postural tone, asymmetry, fixation, and malalignment of body parts. *Treatment*: facilitate an automatic adaptation of postural tone, righting reactions, weight transference and selective movement through trunk mobilizations, control of displacement and dynamic activity.
- 2) *Deviation*: inability to recruit muscle activity in a specific part of the range with reference to the gait cycle, e.g. knee flexion with hip in extension, dorsiflexion with knee extension. *Treatment*: practise these in different positions, using techniques such as stretch, resistance and hold in different parts of the range.
- 3) *Deviation*: restriction of activity due to soft tissue and muscle shortening, resulting in muscle imbalance and contracture. *Treatment*: techniques to lengthen muscle include distraction and rotation combined with stretch, followed by activity, and dynamic stretch in functional positions, e.g. stretch ankle plantar flexors with foot on a wedge before practising toe-off.
- 4) *Deviation*: restriction of peripheral joint mobility. *Treatment*: mobilization, e.g. to the joints of the foot.
- 5) *Deviation*: use of excessive compensatory movements to perform function, e.g. hip hitching to initiate flexion in swing phase of walking. *Treatment*: determine the cause of the compensation and use techniques accordingly, e.g. work on extension of stance leg to improve hip flexion.
- 6) *Deviation*: overactivity of one side in asymmetrical gait. *Treatment*: work for release of overactive side and improved weight transference, through mobilization and selected functional activity.

Task-oriented functional approach (group T)

Each patient performed as many of these tasks as they were able. There was a graduated progression of tasks, in both number of repetitions and level of difficulty, as the patient's functional ability improved. All exercises were done with alternate feet. No other tasks or exercises were used.

- 1) Practice stepping; even stance time on both feet and even step-length.
- 2) Stepping out to the side, across the midline, at different points in an arc.
- 3) Stepping up onto a small stool, step over and backwards.

- 4) Side-stepping onto a small stool.
- 5) Standing on a stool, lower foot to the ground.
- 6) In standing, picking up an object from different positions, and placing it on different sites.
- 7) As above, in step standing.
- 8) Squatting and rising from squat.
- 9) Turning: looking over shoulders, and complete turn
- 10) Walking, stopping to turn and look at an object on request.
- 11) Practising walking, picking up an object, turning and placing the object again.
- 12) Walking within two lines, 20 cm apart (or less as patient improved).
- 13) Walking sideways along a line.
- 14) Walking sideways, with feet crossing over.
- 15) Walking between obstacles placed on the floor, over obstacles, negotiating tight spaces, etc.
- 16) Walking outside on uneven ground, kerbs, etc.
- 17) Practising stairs.
- 18) Balancing/standing on a wobble board.
- 19) Practising treadmill walking.